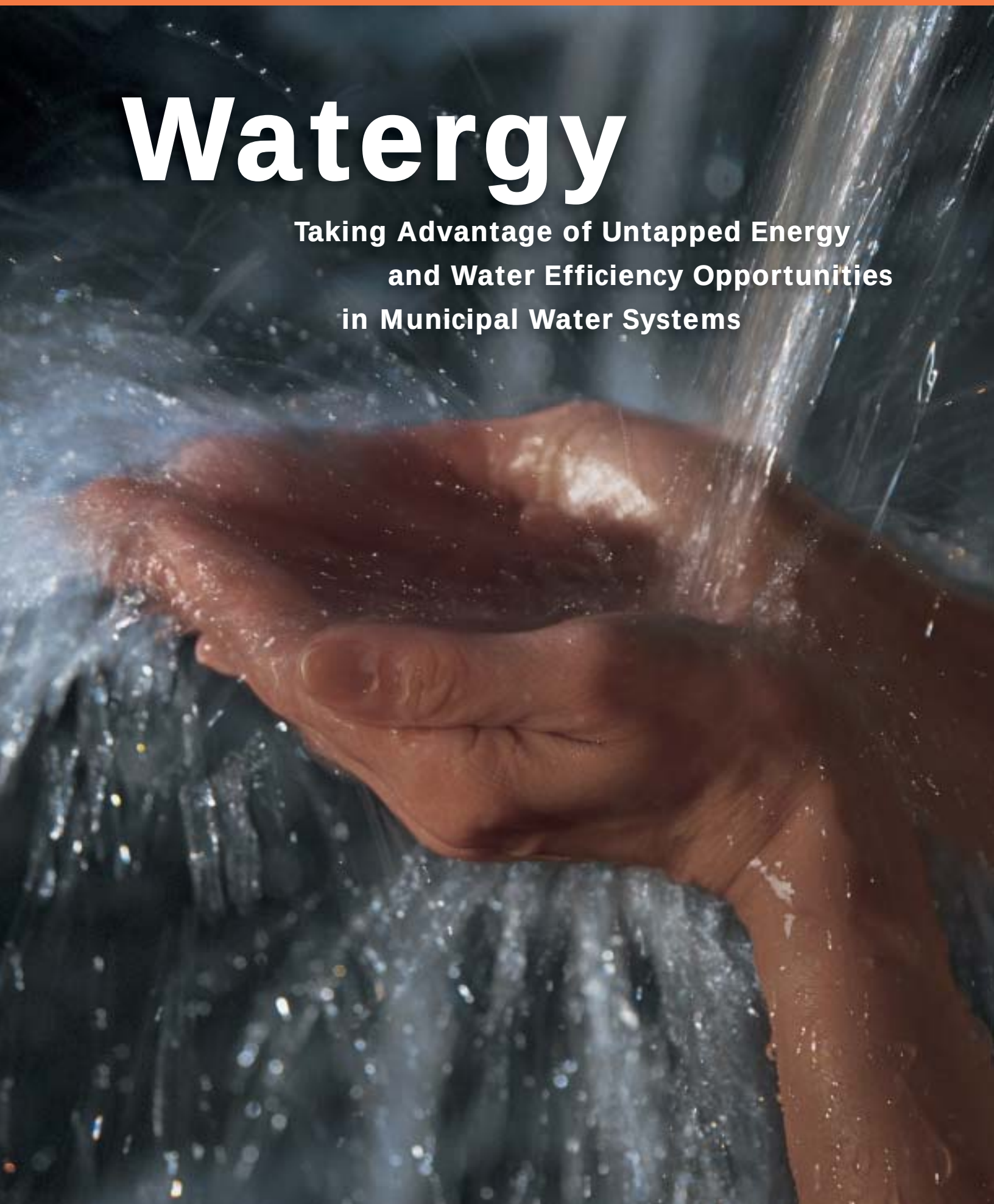
EXECUTIVE SUMMARY



Watergy

Taking Advantage of Untapped Energy and Water Efficiency Opportunities in Municipal Water Systems

Watergy: energy used in water systems

Watergy efficiency: optimizing energy use to cost-effectively meet water needs

Between 2 and 3 percent* of the world's energy consumption is used to pump and treat water for urban residents and industry. Energy consumption in most water systems worldwide could be reduced by at least 25 percent through cost-effective efficiency actions. Water utilities globally have the potential to cost-effectively save more energy than the entire country of Thailand uses annually. Unfortunately, relatively little attention has been given to reducing energy use in municipal water systems.

Energy costs draw precious budgetary resources from other important municipal functions such as education, public transportation, and health care. In the developing world, the cost of energy to supply water may easily consume half of a municipality's total budget. Even in developed countries' municipal water systems, energy is typically the second largest cost after labor.

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The burning of fossil fuels to generate the energy used to supply water affects local and global air quality. Emissions from power plants contribute to already high levels of pollutants in the urban environment and the acidification of lakes and forests. In addition, millions of tons of carbon dioxide are emitted every year, contributing to global climate change. Global climate change has the potential to reduce water tables and disrupt water supplies in many areas, making water even more costly and energy intensive to obtain in the future.

* About 8 Quads (1 Quad = 10^{15} BTU)

Some Utilities Are Leading the Way

Some municipal water managers in cities such as Austin, United States; Toronto, Canada; Stockholm, Sweden; and Sydney, Australia are aggressively taking advantage of opportunities to save energy in their facilities. The Alliance to Save Energy identified more than 30 municipalities implementing a range of simple, cost-effective actions to reduce energy use, while maintaining or even improving service.

The Alliance has worked with several municipalities in the past five years learning about both the potential opportunity for energy savings and the difficulties in achieving them. Fortaleza, Brazil, has dramatically reduced total energy use by 5 MW in its first year after adopting energy efficiency goals, while actually increasing service connections. The city of Indore, India, was able to save 1.6 million rupees (US$35,000) within the first three months of action with no investment cost just by improving the way existing pumps worked together. The city of Pune, India,




quickly identified more than 7 million rupees (US$150,000) of energy savings opportunities after kicking off an energy efficiency program but has only managed to implement one-fifth of the projects.

The utilities we have identified stand in stark contrast to the vast majority of municipal water utilities around the world that have not taken basic measures to reduce energy use. Water system managers frequently do not have the technical knowledge or capacity needed to tackle the numerous efficiency opportunities. In many cases, they lack the necessary metering and monitoring systems to collect data, establish baselines and metrics, and conduct facility assessments. Often when data do exist, they are not shared among departments and groups within a municipal water utility.

Blueprint for Success

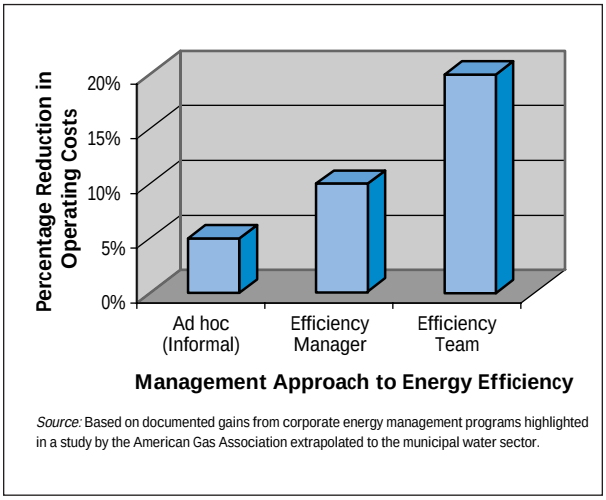
This report outlines the elements of a "watergy efficiency" system optimizing energy use to cost-effectively meet water needs. These elements reflect many of the approaches taken by the water utilities outlined in the case studies boasting the most comprehensive programs.

Utilities employing cross-cutting teams have found that additional energy and capital savings can be achieved when they analyze potential water delivery system improvements while simultaneously promoting more efficient water use by customers. In some instances, reducing the consumer's demand for water may allow for reductions in the capacity needs of pumps and pipes.

Critical steps in building the capacity of the team include supplying the tools to meter and monitor energy and water use, training in energy efficiency techniques, and providing adequate resources to invest in identified projects.

Many worthwhile energy efficiency actions can be completed for little or no cost. In fact,

Expected Efficiency Gains by Water Utility Management Approach to Energy Efficiency



Source: Based on documented gains from corporate energy management programs highlighted in a study by the American Gas Association extrapolated to the municipal water sector.

installing metering and monitoring systems can save 10 percent of energy costs simply through behavioral changes and improved maintenance. While some simple improvements can easily be detected just by metering, many opportunities will remain unexploited without further analysis of data. Many utilities have found benchmarking similar systems within their own operations to be an excellent way to measure energy efficiency progress.

For larger projects, investment capital is commonly a key stumbling block. Finding funds to implement more costly efficiency projects can often be found through savings resulting from other "watergy" efficiency actions such as reducing water waste and theft, improving basic maintenance practices, reducing subsidies, and optimizing system performance.

Identifying Opportunities

Some of the specific water system energy saving opportunities are easy to identify, such as leaks and malfunctioning equipment. Other energy saving actions are more difficult to detect, such as improper system layout or degraded pipes.




Common problems include:

- Leaks
- Low c-value for pipes (high level of friction inside pipes)
- Improper system layout
- System overdesign
- Incorrect equipment selection
- Old, outdated equipment
- Poor maintenance
- Waste of usable water

Remedies may involve:

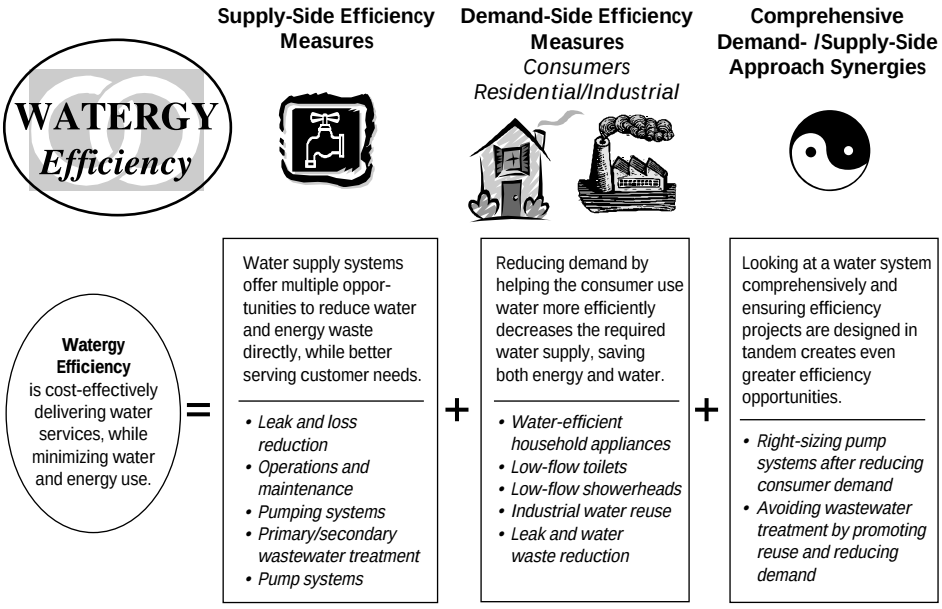
- System redesign and retrofitting of equipment
- Pump impeller reduction
- Leak and loss reductions
- Equipment upgrades
- Low-friction pipe
- Efficient pumps
- Adjustable speed drive motors
- Capacitors
- Transformers
- Maintenance and operation practices improvements
- Water reclamation and reuse

Water utilities often overlook the potential of saving energy and money by reducing the water consumption of their customers. Helping customers do more with less water, using technologies such as low-flush toilets, low-flow showerheads, and energy efficient washing machines is often the most cost-effective way to save energy.

This Problem Is Not Going Away

The urban population of the world is expected to double within the next 40 years. If we continue on the current path, energy consumption by municipal water utilities will double as well. Only half of urban dwellers currently have water connections. Energy prices are rising. Water resources are dwindling at the same time that urban populations are swelling. Municipal water utilities, customers, politicians, the environment, and just about everyone else will pay the price for continued waste. Municipal water utilities therefore have a powerful incentive to pursue the potential of watergy efficiency.

Figure 1: Description of Watergy






Basic Global Watergy Facts

A tremendous amount of energy is used to provide water services globally.

- Energy consumed worldwide for delivering water—more than 26 Quads (1 Quad = 10^{15} BTU)—approximately equals the total amount of energy used in Japan and Taiwan combined, on the order of 7 percent of total world consumption.
- In the United States, the water and wastewater sector annually consumes 75 billion kWh—3 percent of the total consumption of electricity or equal to the total electricity consumed by the pulp and paper and petroleum sectors.

Water is becoming scarcer, often making it more energy intensive to procure.

- Less than 1 percent of the world's freshwater—about 0.008 percent of all water on earth—is readily accessible for direct human use.
- Average annual global renewable water resources equaled 7,045 m^3 per person in the year 2000, a drop of 40 percent per person since 1970, due to growing world population.
- Twenty countries (most of them in Africa and the Middle East) suffer chronic water scarcity, causing severe damage to food production and stunted economic development.
- More energy is required to pump water greater distances and from deeper in the ground.

Major segments of the urban population are not getting adequate service.

- The average city provides electricity connections to only about 85 percent of urban households and may lack sufficient energy supplies to meet existing demand.
- Only about half of urban dwellers in developing countries currently have water connections in their homes and more than one-quarter have no access to safe drinking water.
- To reach universal coverage by 2025, almost 3 billion people need to be linked with water supply and more than 4 billion with sanitation.
- Low-income urban dwellers not connected to water systems often must turn to alternative supplies, such as water vendors who may charge 16 times or more than the formal piped water tariff.

Urban demand for both water and energy resources is expected to grow dramatically.

- Energy use world-wide is expected to grow by more than 60 percent over the next 20 years.
- By 2020 more than 50 percent of the population in developing countries will be urban.
- The total electricity consumption of the water and wastewater sectors will grow globally by a predicted 33 percent in the next 20 years.
- Global water consumption grew sixfold between 1900 and 1995.
- In 2025 one-third of the global population is expected to live in chronic water shortage areas.

To help meet the water and energy resource needs, municipalities can reduce energy and water waste.

- Municipal water utilities alone can cost-effectively save more energy (on the order of 2.5 Quads) than the entire country of Thailand consumes in a year through simple efficiency steps.
- Eliminating unaccounted-for water (leaks, theft, etc.) in many large cities in developing countries would more than double the amount of water available for delivery and drastically reduce energy use.

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